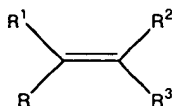


What is claimed is:

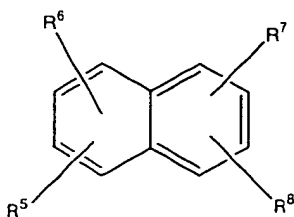
1. A metal plating bath comprising an additive consumption inhibiting alcohol and a salt of a metal selected from metals consisting of copper, gold, silver, palladium, platinum, cobalt, cadmium, chromium, bismuth, indium, rhodium, ruthenium, and iridium.
2. The metal plating bath of claim 1, wherein the additive consumption inhibiting alcohol is a compound with a formula as follows:



wherein R, R¹, R² and R³ independently comprise hydrogen; -OH; hydroxy (C₁-C₂₀) linear, branched, or cyclic alkyl; hydroxy (C₂-C₂₀) linear, or branched alkenyl; hydroxy (C₂-C₂₀) linear, or branched alkynyl; hydroxy (C₁-C₂₀) linear, or branched alkoxy; hydroxyaryl; (C₁-C₂₀) linear, branched, or cyclic alkyl; (C₂-C₂₀) linear, or branched alkenyl; (C₂-C₂₀) linear, or branched alkynyl; (C₁-C₂₀) linear, or branched alkynyl; aryl; halogen; thienyl; silane; silyl; -Si(OH)₃; aminyl; aminyl halide; hydroxy aminyl; -CN; SCN; -C=NS; -SH; -NO₂; SO₂H; -SO₃M; PO₃M; keto; ester; -P(R⁴), where R⁴ is hydrogen or halogen; or acyl halide; provided that at least one of R, R¹, R², or R³ is -OH, hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, or hydroxyaryl; and M is hydrogen or an alkali metal; the hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, hydroxy aryl, (C₂-C₂₀) alkyl, (C₂-C₂₀) alkenyl, (C₂-C₂₀) alkynyl, and the aryl groups may be unsubstituted or substituted; or

R¹ and R² are taken together to form a bond; or R¹ and R² are taken together along with the atoms to which they are attached to form a 5 to 7 membered carbon ring optionally fused with one or more five or six membered carbon rings; the 5 to 7 membered ring and the one or more five to six membered fused ring may each optionally contain one or more carbonyls in the ring; or the 5 to 7 membered ring, or the one or more five or six membered fused ring may each optionally contain a hetero-atom such as oxygen or nitrogen to form a heterocyclic ring; the heterocyclic ring may contain a carbonyl group in the ring; the 5 to 7 membered rings, the 5 to 6 membered fused rings and the heterocyclic rings may be unsubstituted or substituted; and R and R³ are as defined above; when R¹ and R² are taken together to form a bond or ring structure at least one OH group is present on the compound.

3. The metal plating bath of claim 2, wherein the hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, hydroxyaryl, (C₁-C₂₀) alkyl, (C₁-C₂₀) alkoxy, (C₂-C₂₀) alkenyl, (C₂-C₂₀) alkynyl, aryl, the 5 to 7 membered rings, the 5 to 6 membered fused rings, or the heterocyclic rings are substituted with one or more substituents comprising halogen, silyl, silane, -Si(OH)₃, aminyl, aminyl halide, hydroxy aminyl, -OH, CN, -SCN, -C=NS, -SH, -NO₂, -SO₂H, -SO₃M, -PO₃M, P(R⁴), ester, keto, alkoxy, pentose, hexose, or combinations thereof.
4. The metal plating bath of claim 3, wherein the additive consumption inhibiting compound comprises naphthalene compounds having the following formula:



where R⁵, R⁶, R⁷, and R⁸ are each independently selected from R.

5. The metal plating bath of claim 4, wherein the naphthalene derivatives comprise 1,2-dihydroxynaphthalene, 1,3-dihydroxynaphthalene, 2,3-dihydroxynaphthalene, 2,4-dihydroxynaphthalene, 2,7-dihydroxynaphthalene, 2,6-dihydroxynaphthalene, 4,5-dihydroxynaphthalene-2,7-disulfonic acid disodium salt, 6,7-dihydroxynaphthalene-2,7-disulfonic acid, 6-hydroxy-2-naphthalene sulfonic acid, 4-amino-5-hydroxy-2,7-naphthalene disulfonic acid monosodium salt, 1,5-dihydroxy-1,2,3,4-tetrahydronaphthalene, 2,6-dihydroxynaphthalene, 1,5-dihydroxynaphthalene, 1-naphthol-3,6-disulfonic acid disodium salt hydrate, decahydro-2-naphthol, 1,2,3,4-tetrahydro-1-naphthol, 2-naphthalene methanol, 1,6-dihydroxynaphthalene, 6,7-dihydroxy-2-naphthalene sulfonic acid hemihydrate or 4-hydroxy-1-naphthalene sulfonic acid sodium salt.
6. The metal plating bath of claim 3, wherein the additive consumption inhibiting compound comprises 5-methoxyresorcinol, 4-chlororesorcinol, 2-nitroresorcinol, 2-allyl phenol, 1,2,4-benzenetriol, isoeugenol, α,α,α-trifluoro-m-cresol, cresol, 4-tert-butyl catechol, 3-hydroxy-1-benzyl alcohol, 4-hydroxybenzyl alcohol, phloroglucinol dihydrate, anhydride, olivetol, 3-chlorophenol, 1,2-benzenedimethanol, 1,3-benzendimethanol, 4-aminophenol, 4-methoxyphenol, 4-ethylresorcinol, hydroquinone, chloroquinone, hydroquinone sulfonic acid potassium salt, 4-

(methylthio)-benzyl alcohol, benzyl alcohol, coniferyl alcohol, 3-methoxycatechol, 4-mercapto phenol, 4,4'-thiodiphenol, 3-methoxy phenol, phenol, or orcinol monohydrate.

7. The metal plating bath of claim 3, wherein the additive consumption inhibiting compound comprises ascorbic acid, α -hydroxy- γ -butyrolactone, or sodium, potassium or iron salts thereof.

8. The metal plating bath of claim 3, wherein the additive consumption inhibiting compound comprises 2-hydroxybenzofuran, 5,6-dihydro-4-hydroxy-6-methyl-2H-pyran-2-one, 2-hydroxybenzofuran, naringin hydrate, sesamol, or 2,4-dihydroxy-6-methyl pyrimidine.

9. The metal plating bath of claim 3, wherein the additive consumption inhibiting compound comprises crotyl alcohol, 2-methylene-1,3-propanediol, 3-butene-1-ol, or 1,4-anhydro-erythritol.

10. The metal plating bath of claim 1, wherein the additive consumption inhibiting alcohol comprises from about 0.001 g/L to about 100 g/L of the bath.

11. The metal plating bath of claim 1, further comprising additives comprising brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, or suppressors.

12. The metal plating bath of claim 11, wherein the brighteners comprise compounds having the formulas: $\text{HO}_3\text{-S-R}^{11}\text{-SH}$; $\text{HO}_3\text{S-R}^{11}\text{-S-S-R}^{11}\text{-SO}_3\text{H}$, where R^{11} is $\text{C}_1\text{-C}_6$ alkyl or an aryl group; or $\text{HO}_3\text{-Ar-S-S-Ar-SO}_3\text{H}$, where Ar is phenyl or naphthyl, the alkyl and aryl groups may be unsubstituted or substituted with an alkyl group, halo or alkoxy group.

13. The metal plating bath of claim 12, wherein the brighteners comprise 3-mercapto-propylsulfonic acid sodium salt, 2-mercapto-ethanesulfonic acid sodium salt, bisulfopropyl disulfide, or mixtures thereof.

14. The plating bath of claim 11, wherein the levelers comprise alkylated polyalkyleneimines, organo sulfo sulfones, dyes of the phenazine class, phenazine azo dyes, or mixtures thereof.

15. The plating bath of claim 11, further comprising the additives 3-(benzthiazoyl-2-thio)-propylsulfonic acid sodium salt, 3-mercapto propane-1-sulfonic acid sodium salt, ethylenedithiodipropylsulfonic acid sodium salt, bis-(p-sulfopehnyl)-disulfide disodium salt, bis-(ω -sulfoethyl)-disulfide disodium salt, bis-(ω -sulfohydroxypropyl)-disulfide disodium salt, bis-(ω -sulfopropyl)-disulfide disodium salt, bis-(ω -sulfopropyl)-sulfide disodium salt, methyl-(ω -sulfopropyl) sodium salt, methyl-(ω -sulfopropyl)-trisulfide disodium salt, O-ethyl-dithiocarbonic acid-S-(ω -sulfopropyl)-ester, potassium salt thioglycolic acid, thiophosphoric acid-O-ethyl-bis-(ω -sulfopropyl)-ester disodium salt, thiophosphoric acid-tri(ω -sulfopropyl)-ester trisodium salt,

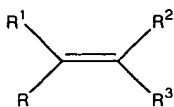
N,N-dimethyldithiocarbamic acid (3-sulfopropyl) ester sodium salt, (O-ethyldithiocarbonato)-S-(3-sulfopropyl) ester potassium salt, 3-[(amino-iminomethyl)-thio]-1-propanesulfonic acid, 3-(2-benzthiazolylthio)-1-propanesulfonic acid sodium salt, or mixtures thereof.

16. The plating bath of claim 11, further comprising the additives carboxymethylcellulose, nonyphenolpolyglycol ether, octandiolbis-(polyalkylene glycolether), octanolpolyalkylene glycolether, oleic acidpolyglycol ester, polyethylenepropylene glycol, polyethylene glycol, polyethylene glycoldimethylether, polyoxypropylene glycol, polypropylene glycol, polyvinylalcohol, stearic acidpolyglycol ester, stearyl alcoholpolyglycol ether, or mixtures thereof.

17. The metal plating bath of claim 1, wherein the pH of the bath ranges from 0 to about 8.0.

18. A copper metal plating bath comprising a copper salt, and an additive consumption inhibiting alcohol.

19. The copper metal plating bath of claim 18, wherein the additive consumption inhibiting alcohol is a compound having a formula:



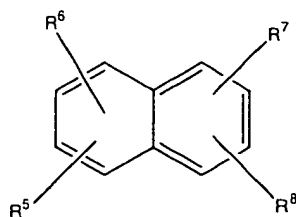
wherein R, R¹, R² and R³ independently comprise hydrogen; -OH; hydroxy (C₁-C₂₀) linear, branched, or cyclic alkyl; hydroxy (C₂-C₂₀) linear, or branched alkenyl; hydroxy (C₂-C₂₀) linear, or branched alkynyl; hydroxy (C₁-C₂₀) linear, or branched alkoxy; hydroxyaryl; (C₁-C₂₀) linear, branched, or cyclic alkyl; (C₂-C₂₀) linear, or branched alkenyl; (C₂-C₂₀) linear or branched alkynyl; (C₁-C₂₀) linear or branched alkoxy; aryl; halogen; thienyl; silyl; silane; -Si(OH)₃; -CN; SCN; -C=NS; -SH; -NO₂; SO₂H; -SO₃M; -PO₃M; -P(R⁴)₂; aminyl; aminyl halide; hydroxy aminyl; keto; ester; or acyl halide; provided that at least one of R, R¹, R² or R³ is -OH, hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, or hydroxyaryl; R⁴ is hydrogen or halogen; and M is hydrogen, or an alkali metal; the hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxyaryl, hydroxy (C₁-C₂₀) alkoxy, (C₁-C₂₀) alkyl, (C₂-C₂₀) alkenyl, (C₂-C₂₀) alkynyl, (C₁-C₂₀) alkoxy and the aryl groups may be unsubstituted or substituted; or

R¹ and R² are taken together to form a bond; or R¹ and R² may be taken together along with the atoms to which they are attached to form a 5 to 7 membered carbon ring, the 5 to 7 membered ring may comprise one or more carbonyl groups; the 5 to 7 membered ring may optionally be

fused with one or more five or six membered rings, the one or more five or six membered rings may contain one or more carbonyl groups in the ring; the 5 to 7 membered rings and the one or more five or six membered fused rings may be replace a carbon atom of the ring with a hetero-atom to form a heterocyclic ring, the hetero-atom may be oxygen or nitrogen; the 5 to 7 membered ring, the 5 to 6 membered fused ring or the heterocyclic ring may be unsubstituted or substituted; and R and R³ are as defined above; and when R¹ and R² are taken together to form a bond or ring structure, at least one -OH group is present on the compound.

20. The copper metal plating bath of claim 19, wherein the hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, hydroxyaryl, (C₁-C₂₀) alkyl, (C₂-C₂₀) alkenyl, (C₂-C₂₀) alkynyl, (C₁-C₂₀) alkoxy, aryl, the 5 to 7 membered ring, the 5 to 6 membered fused ring, and the heterocyclic ring may be substituted with one or more substituents comprising halogen, silyl, silane, -Si(OH)₃, aminyl, aminyl halide, hydroxyaminyl, acyl halide, OH, -CN, -SCN, -C=NS, SH, -NO₂, -SO₂H, -SO₃M, -PO₃M, -P(R⁴)₂, keto, ester, or alkoxy.

21. The copper metal plating bath of claim 20, wherein the additive consumption inhibiting compound comprises naphthalene compounds having the following formula:



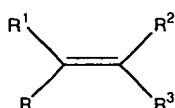
where R⁵, R⁶, R⁷, and R⁸ are each independently selected from R.

22. The copper metal plating bath of claim 21, wherein the naphthalene compounds comprise 1,2-dihydroxynaphthalene, 1,3-dihydroxynaphthalene, 2,3-dihydroxynaphthalene, 2,4-dihydroxynaphthalene, 2,7-dihydroxynaphthalene, 2,6-dihydroxynaphthalene, 4,5-dihydroxynaphthalene-2,7-disulfonic acid disodium salt, 6,7-dihydroxynaphthalene-2,7-disulfonic acid, 6-hydroxy-2-naphthalene sulfonic acid, 4-amino-5-hydroxy-2,7-naphthalene disulfonic acid monosodium salt, 1,5-dihydroxy-1,2,3,4-tetrahydronaphthalene, 2,6-dihydroxynaphthalene, 1,5-dihydroxynaphthalene, 1-naphthol-3,6-disulfonic acid disodium salt hydrate, decahydro-2-naphthol, 1,2,3,4-tetrahydro-1-naphthol, 2-naphthalene methanol, 1,6-dihydroxynaphthalene, 6,7-dihydroxy-2-naphthalene sulfonic acid hemihydrate, or 4-hydroxy-1-naphthalene sulfonic acid sodium salt.

23. The copper metal plating bath of claim 20, wherein the additive consumption inhibiting compound comprises 5-methoxyresorcinol, 4-chlororesorcinol, 2-nitroresorcinol, 2-allyl phenol, 1,2,4-benzenetriol, isoeugenol, α,α,α -trifluoro-m-cresol, cresol, 4-tert-butyl catechol, 3-hydroxy-1-benzyl alcohol, phenyl methyl, phloroglucinol dihydrate, anhydrate, olivetol, 3-chlorophenol, 1,2-benzenedimethanol, 1,3-benzenedimethanol, 4-aminophenol, 4-methoxyphenol, 4-ethylresorcinol, hydroquinone, chloroquinone, hydroquinone sulfonic acid potassium salt, 4-(methylthio)-benzyl alcohol, benzyl alcohol, coniferyl alcohol, 3-methoxycatechol, 4-mercapto-phenol, 4,4'-thiodiphenol, 3-methoxy phenol, phenol, orcinol monohydrate, or mixtures thereof.
24. The copper metal plating bath of claim 20, wherein the additive consumption inhibiting compounds comprise 2-hydroxybenzofuran, 5,6-dihydro-4-hydroxy-6-methyl-2H-pyran-2-one, 2-hydroxybenzofuran, naringin hydrate, sesamol, or 2,4-dihydroxy-6-methyl pyrimidine, or mixtures thereof.
25. The copper metal plating bath of claim 20, wherein the additive consumption inhibiting compound comprises crotyl alcohol, 2,1-methylene-1,3-propanediol, 3-butene-1-ol, or 1,4-anhydroerythritol.
26. The copper metal plating bath of claim 18, wherein the additive consumption inhibiting alcohol comprises from about 0.001 g/L to about 100 g/L of the bath.
27. The copper metal plating bath of claim 18, wherein the copper salt comprises copper halides, copper sulfates, copper alkane sulfonate, copper alkanol sulfonate, or mixtures thereof.
28. The copper metal plating bath of claim 18, wherein the bath has a pH of from 0 to about 8.0.
29. The copper metal plating bath of claim 18, further comprising additives comprising brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, suppressants, or mixtures thereof.
30. The copper metal plating bath of claim 29, wherein the brighteners comprise compounds having the formulas: $\text{HO}_3\text{-S-R}^{11}\text{-SH}$; $\text{HO}_3\text{-S-R}^{11}\text{-S-S-R}^{11}\text{-SO}_3\text{H}$, where R^{11} is $\text{C}_1\text{-C}_6$ alkyl or aryl group; or $\text{HO}_3\text{-Ar-S-S-Ar-SO}_3\text{H}$, where Ar is phenyl or naphthyl, the alkyl and aryl groups may be unsubstituted or substituted with an alkyl group, halo, or alkoxy.
31. The copper metal electroplating bath of claim 29, wherein the levelers comprise alkylated polyalkyleneimines, organo sulfo sulfones, dyes of the phenazine class, phenazine azo dyes, or mixtures thereof.

32. A method for plating a metal on a substrate comprising: contacting the substrate with a metal plating bath; and applying a sufficient current density to the plating bath to deposit the metal on the substrate; the metal plating bath comprises an additive consumption inhibiting alcohol and a salt of a metal selected from metals consisting of copper, gold, silver, palladium, platinum, cobalt, cadmium, chromium, bismuth, indium, rhodium, ruthenium, and iridium.

33. The method of claim 32, wherein the additive consumption inhibiting alcohol is a compound having the formula:



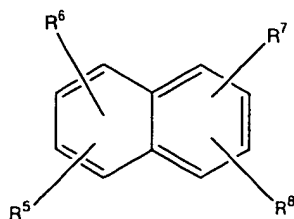
where R, R¹, R², and R³ independently comprise hydrogen; -OH; hydroxy (C₁-C₂₀) linear, branched, or cyclic alkyl; hydroxy (C₂-C₂₀) linear, or branched alkenyl; hydroxy (C₂-C₂₀) linear, or branched alkynyl; hydroxy (C₁-C₂₀) linear, or branched alkoxy; hydroxyaryl; (C₁-C₂₀) linear, or branched alkyl; (C₂-C₂₀) linear or branched alkenyl; (C₂-C₂₀) linear or branched alkynyl; (C₁-C₂₀) linear or branched alkoxy; aryl; halogen; thienyl; -CN; -SCN; -C=NS; -SH; -NO₂; SO₂H; -SO₃M; -PO₃M; -P(R⁴); silyl; silane; -Si(OH)₃; aminyl; aminyl halide; hydroxyaminyl; or acyl halide; provided that at least one of R, R¹, R², or R³ is -OH, hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, or hydroxyaryl; R⁴ is hydrogen or halogen; and M is hydrogen or an alkali metal; or

R¹ and R² are taken together to form a bond; or R¹ and R² are taken together along with atoms to which they are attached to form a 5 to 7 membered carbon ring; the 5 to 7 membered carbon ring may contain a carbonyl group; or the 5 to 7 membered carbon ring may be fused with a five to six membered ring, the 5 or 6 membered fused ring may have a carbonyl group in the ring; the 5 to 7 membered ring or the 5 to 6 membered fused ring may have a carbon replaced by a hetero-atom in the ring, the hetero-atom may be an oxygen or a nitrogen; the 5 to 7 membered rings and the fused five or six membered rings may be unsubstituted or substituted; and R and R³ are as defined above; when R¹ and R² are taken together to form a bond or a ring, at least one -OH group is present on the compound.

34. The method of claim 33, wherein the hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, hydroxyaryl, (C₁-C₂₀) alkyl, (C₂-C₂₀) alkenyl, (C₂-C₂₀) alkynyl, (C₁-C₂₀) alkoxy, aryl, the 5 to 7 membered ring, the 5 to 6 membered ring and the heterocyclic ring are substituted with one or more substituents comprising halogen,

-OH, -CN, -SCN, -C=NS, -SH, NO₂, -SO₂H, -SO₃M, -PO₃M, -P(R⁴)₂, silyl, silane, -Si(OH)₃, keto, ester, aminyl, aminyl halide, hydroxyaminyl, pentose, or hexose.

35. The method of claim 33, wherein the additive consumption inhibiting compound comprises naphthalene compounds having the following formula:



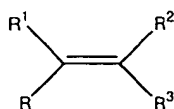
where R⁵, R⁶, R⁷, and R⁸ are each independently selected from R.

36. The method of claim 35, wherein the naphthalene compounds comprise 1,2-dihydroxynaphthalene, 1,3-dihydroxynaphthalene, 2,3-dihydroxynaphthalene, 2,4-dihydroxynaphthalene, 2,7-dihydroxynaphthalene, 2,6-dihydroxynaphthalene, 4,5-dihydroxynaphthalene-2,7-disulfonic acid disodium salt, 6,7-dihydroxynaphthalene-2,7-disulfonic acid, 6-hydroxy-2-naphthalene sulfonic acid, 4-amino-5-hydroxy-2,7-naphthalene disulfonic acid monosodium salt, 1,5-dihydroxy-1,2,3,4-tetrahydro-naphthalene, 2,6-dihydroxynaphthalene, 1,5-dihydroxynaphthalene, 1-naphthol-3,6-disulfonic acid disodium salt hydrate, decahydro-2-naphthol, 1,2,3,4-tetrahydro-1-naphthol, 2-naphthalene methanol, 1,6-dihydroxynaphthalene, 6,7-dihydroxy-2-naphthalene sulfonic acid hemihydrate, or 4-hydroxy-1-naphthalene sulfonic acid sodium salt.

37. The method of claim 33, wherein the additive consumption inhibiting compound comprises 5-methoxyresorcinol, 4-chlororesorcinol, 2-nitroresorcinol, 2-allyl phenol, 1,2,4-benzenetriol, isoeugenol, α,α,α -trifluoro-m-cresol, cresol, 4-tert-butyl catechol, 3-hydroxy-1-benzyl alcohol, 4-hydroxybenzyl alcohol, phloroglucinol dihydrate, olivetol, 3-chlorophenol, 1,2-benzenedimethanol, 1,3-benzenedimethanol, 4-aminophenol, 4-methoxyphenol, 4-ethylresorcinol, hydroquinone, chloroquinone, hydroquinone sulfonic acid potassium salt, 4-(methylthio)-benzyl alcohol, benzyl alcohol, coniferyl alcohol, 3-methoxy catechol, 4-mercapto phenol, 4,4'-thiophenol, 3-methoxy phenol, phenol, or orcinol monohydrate.

38. The method of claim 33, wherein the additive consumption inhibiting compound comprises ascorbic acid, α -hydroxy- γ -butyrolactone, or sodium, potassium or iron salts thereof.

39. The method of claim 33, wherein the additive consumption inhibiting compound comprises 2-hydroxybenzofuran, 5,6-dihydro-4-hydroxy-6-methyl-2H-pyran-2-one, 2-hydroxybenzofuran, naringin hydrate, sesamol, or 2,4-dihydroxy-6-methyl pyrimidine.
40. The method of claim 33, wherein the additive consumption inhibiting compound comprises crotyl alcohol, 2-methylene-1,3-propanediol, 3-butene-1-ol, or 1,4-anhydroerythritol.
41. The method of claim 32, wherein the additive consumption inhibiting compound comprises from about 0.001 g/L to about 100 g/L of the bath.
42. The method of claim 32, wherein the bath has a pH of from 0 to about 8.0.
43. The method of claim 32, further comprising brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, suppressants, or mixtures thereof.
44. The method of claim 43, wherein the brighteners comprise compounds of having the formulas: $\text{HO}_3\text{-S-R}^{\text{II}}\text{-SH}$; $\text{HO}_3\text{-S-R}^{\text{II}}\text{-S-S-R}^{\text{II}}\text{-SO}_3\text{H}$, where R^{II} is $\text{C}_1\text{-C}_6$ alkyl or an aryl group; or $\text{HO}_3\text{-Ar-S-S-Ar-SO}_3\text{H}$, where Ar is phenyl or naphthyl, the alkyl and aryl groups may be unsubstituted or substituted with an alkyl group, halo or alkoxy group.
45. The method of claim 32, wherein the substrate comprises a printed wiring board, an integrated circuit, an electrical contact surface, a connector, an electrolytic foil, a silicon wafer, a semi-conductor, a lead frame, a optoelectronic component, a solder bump, a decorative article, a sanitary appliance, and the like.
46. A method for plating copper metal on a substrate comprising: contacting the substrate with a copper plating bath; and applying sufficient current density to the copper plating bath to deposit copper metal on the substrate; the copper metal plating bath comprises a copper salt and an additive consumption inhibiting alcohol.
47. The method of claim 46, wherein the additive consumption inhibiting alcohol is a compound having the formula:

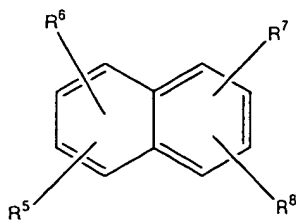


where R, R^1 , R^2 , and R^3 independently comprise hydrogen; -OH; hydroxy ($\text{C}_1\text{-C}_{20}$) linear, branched, or cyclic alkyl; hydroxy ($\text{C}_2\text{-C}_{20}$) linear, or branched alkenyl; hydroxy ($\text{C}_2\text{-C}_{20}$) linear, or branched alkynyl; hydroxy ($\text{C}_1\text{-C}_{20}$) linear, or branched alkoxy; hydroxyaryl; ($\text{C}_1\text{-C}_{20}$) linear, or branched alkyl; ($\text{C}_2\text{-C}_{20}$) linear, or branched alkenyl; ($\text{C}_2\text{-C}_{20}$) linear, or branched alkynyl; ($\text{C}_1\text{-$

C₂₀) linear, or branched alkoxy; aryl; halogen; thienyl; silyl; silane; -Si(OH)₃; aminyl; aminyl halide; hydroxyaminyl; -CN; -SCN; -C=NS; -SH; -NO₂; SO₂H; -SO₃M; -PO₃M; -P(R⁴); keto; ester; or acyl halide; provided that at least one of R, R¹, R², or R³ is -OH, hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, or hydroxyaryl; R⁴ is hydrogen or halogen; and M is hydrogen or an alkali metal; the hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, hydroxyaryl, (C₁-C₂₀) alkyl, (C₂-C₂₀) alkenyl, (C₂-C₂₀) alkynyl, (C₁-C₂₀) alkoxy, or aryl may be unsubstituted or substituted; or R¹ and R² are taken together to form a bond; or R¹ and R² are taken together along with the atoms to which they are attached to form a 5 to 7 membered carbon rings, the 5 to 7 membered rings may have a carbonyl group; or to form a 5 to 7 membered carbon rings fused with a five to six membered rings, the 5 to 6 membered rings may have a carbonyl in the ring; or the 5 to 7 membered rings or the 5 to 6 membered fused rings may have a hetero-atom to form a heterocyclic ring where oxygen or nitrogen are hetero-atoms in the ring; the 5 to 7 membered rings, the five or six membered fused rings, and the heterocyclic rings may be unsubstituted or substituted; and R and R³ are as defined above; when R¹ and R² are taken together to form a bond or ring structure, at least one -OH group is present on the compound.

48. The method of claim 47, wherein the hydroxy (C₁-C₂₀) alkyl, hydroxy (C₂-C₂₀) alkenyl, hydroxy (C₂-C₂₀) alkynyl, hydroxy (C₁-C₂₀) alkoxy, hydroxyaryl, (C₁-C₂₀) alkyl, (C₂-C₂₀) alkenyl, (C₂-C₂₀) alkynyl, (C₁-C₂₀) alkoxy, aryl, the 5 to 7 membered rings, the 5 to 6 membered fused rings, and the heterocyclic rings are substituted with one or more substituents comprising halogen, -OH, -CN, -SCN, -C=NS, -SH, -NO₂, -SO₂H, -SO₃M, -PO₃M, -P(R⁴)₂, keto, ester, silyl, silane, -Si(OH)₃, aminyl, aminyl halide, hydroxyaminyl, pentose, hexose, or combinations thereof.

49. The method of claim 47, wherein the additive consumption inhibiting compound comprises naphthalene compounds having the following formula:



where R⁵, R⁶, R⁷, and R⁸ are each independently selected from R.

50. The method of claim 49, wherein the naphthalene compound comprises 1,2-dihydroxynaphthalene, 1,3-dihydroxynaphthalene, 2,3-dihydroxynaphthalene, 2,4-dihydroxynaphthalene, 2,7-dihydroxynaphthalene, 2,6-dihydroxynaphthalene, 4,5-dihydroxynaphthalene-2,7-disulfonic acid disodium salt, 6,7-dihydroxynaphthalene-2,7-disulfonic acid, 6-hydroxy-2-naphthalene sulfonic acid, 4-amino-5-hydroxy-2,7-naphthalene disulfonic acid monosodium salt, 1,5-dihydroxy-1,2,3,4-tetrahydronaphthalene, 2,6-dihydroxynaphthalene, 1,5-dihydroxynaphthalene, 1-naphthol-3,6-disulfonic acid disodium salt hydrate, decahydro-2-naphthol, 1,2,3,4-tetrahydro-1-naphthol, 2-naphthalene methanol, 1,6-dihydroxynaphthalene, 6,7-dihydroxy-2-naphthalene sulfonic acid hemihydrate, or 4-hydroxy-1-naphthalene sulfonic acid sodium salt.
51. The method of claim 47, wherein the additive consumption inhibiting compound comprises 5-methoxyresorcinol, 4-chlororesorcinol, 2-nitroresorcinol, 2-allyl phenol, 1,2,4-benzenetriol, isoeugenol, α,α,α -trifluoro-m-cresol, cresol, 4-tert-butyl catechol, 3-hydroxy-1-benzyl alcohol, 4-hydroxybenzyl alcohol, phloroglucinol dihydrate, olivetol, 3-chlorophenol, 1,2-benzenedimethanol, 1,3-benzenedimethanol, 4-aminophenol, 4-methoxyphenol, 4-ethylresorcinol, hydroquinone, chloroquinone, hydroquinone sulfonic acid potassium salt, 4-(methylthio)-benzyl alcohol, benzyl alcohol, coniferyl alcohol, 3-methoxy catechol, 4-mercapto phenol, 4,4'-thiophenol, 3-methoxy phenol, phenol, orcinol monohydrate or mixtures thereof.
52. The method of claim 47, wherein the additive consumption inhibiting compound comprises ascorbic acid, α -hydroxy- γ -butyrolactone, or sodium, potassium or iron salts thereof.
53. The method of claim 47, wherein the additive consumption inhibiting compound comprises 2-hydroxybenzofuran, 5,6-dihydro-4-hydroxy-6-methyl-2H-pyran-2-one, 2-hydroxybenzofuran, naringin hydrate, sesamol, or 2,4-dihydroxy-6-methyl pyrimidine.
54. The method of claim 47, wherein the additive consumption inhibiting compound comprises crotyl alcohol, 2-methylen, 1,3-propanediol, 3-butene-1-ol, 1,4-anhydroerythritol, or mixtures thereof.
55. The method of claim 46, wherein the additive consumption inhibiting compound comprises from about 0.001 g/L to about 100 g/L of the bath.
56. The method of claim 46, wherein the bath has a pH of from 0 to about 8.0.

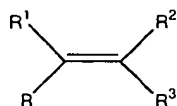
57. The method of claim 46, further comprising brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, suppressants, or mixtures thereof.

58. The method of claim 57, wherein the brighteners comprise compounds having the formulas: $\text{HO}_3\text{-S-R}^{11}\text{-SH}$; $\text{HO}_3\text{-S-R}^{11}\text{-S-S-R}^{11}\text{-SO}_3\text{H}$, where R^{11} is $\text{C}_1\text{-C}_6$ alkyl or an aryl group; or $\text{HO}_3\text{S-Ar-S-S-Ar-SO}_3\text{H}$, where Ar is phenyl or naphthyl, the alkyl and aryl groups may be unsubstituted or substituted with an alkyl group, halo or alkoxy group.

59. The method of claim 46, wherein the electroplating method may be employed to plate a substrate in manufacturing printed wiring boards, integrated circuits, electrical contact surfaces, connectors, electrolytic foil, silicon wafers, semi-conductors, lead frames, optoelectronic components, solder bumps, decorative articles, sanitary appliances and the like.

60. An apparatus for electroplating a substrate comprising an electrical power source electrically connected with an insoluble anode and a cathode such that an electrical current can pass through the insoluble anode and the cathode, the insoluble anode and the cathode are in contact with a metal plating bath comprising a salt of a metal selected from the group consisting of copper, gold, silver, palladium, platinum, cobalt, cadmium, chromium, bismuth, indium, rhodium, iridium, and ruthenium, and an additive consumption inhibiting alcohol.

61. The apparatus of claim 60, wherein the additive consumption inhibiting compound is a compound having a formula as follows:

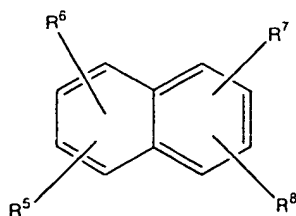


wherein R, R^1 , R^2 and R^3 independently comprise hydrogen; -OH; hydroxy ($\text{C}_1\text{-C}_{20}$) linear, branched, or cyclic alkyl; hydroxy ($\text{C}_2\text{-C}_{20}$) linear, or branched alkenyl; hydroxy ($\text{C}_2\text{-C}_{20}$) linear, or branched alkynyl; hydroxy ($\text{C}_1\text{-C}_{20}$) linear, or branched alkoxy; hydroxyaryl; ($\text{C}_1\text{-C}_{20}$) linear, or branched alkyl; ($\text{C}_2\text{-C}_{20}$) linear, or branched alkenyl; ($\text{C}_2\text{-C}_{20}$) linear, or branched alkynyl; aryl; halogen; thienyl; -CN; -SCN; -C=NS; -SH; -NO₂; -SO₂H; -SO₃M; -PO₃M; -P(R^4); -Si(OH)₃; silyl; silane; aminyl; aminyl halide; hydroxyaminyl; keto; ester; or acyl halide; provided that at least one of R, R^1 , R^2 , or R^3 is -OH, hydroxy ($\text{C}_1\text{-C}_{20}$) alkyl, hydroxy ($\text{C}_2\text{-C}_{20}$) alkenyl, hydroxy ($\text{C}_2\text{-C}_{20}$) alkynyl, hydroxy ($\text{C}_1\text{-C}_{20}$) alkoxy, or hydroxyaryl; R^4 is hydrogen or halogen; and M is hydrogen or an alkali metal; or

R^1 and R^2 are taken together to form a bond; or R^1 and R^2 are taken together along with the atoms to which they are attached to form a 5 to 7 membered carbon ring; or to form a 5 to 7 membered carbon ring fused with one or more five to six membered rings carbon rings; the 5 to 7 membered rings and the one or more five to six membered rings may each contain one or more carbonyls in the ring; or the 5 to 7 membered ring or the one or more five to six membered fused rings may each contain a hetero-atom to replace a carbon in the ring to form a heterocyclic ring, where oxygen or nitrogen are hetero-atoms in the ring; the 5 to 7 membered rings and the five to six membered fused rings may be unsubstituted or substituted; and R and R^3 are as defined above; when R^1 and R^2 are taken together to form a bond or ring structure, at least one $-OH$ group is present on the compound.

62. The apparatus of claim 61, wherein the hydroxy (C_1 - C_{20}) alkyl, hydroxy (C_2 - C_{20}) alkenyl, hydroxy (C_2 - C_{20}) alkynyl, hydroxy (C_1 - C_{20}) alkoxy, hydroxyaryl, (C_1 - C_{20}) alky, (C_2 - C_{20}) alkenyl, (C_2 - C_{20}) alkynyl, (C_1 - C_{20}) alkoxy, aryl, the 5 to 7 membered rings, the five to six membered fused rings, and the heterocyclic rings are substituted with one or more substituents comprising halogen, $-OH$, $-CN$, $-SCN$, $-C=NS$, $-SH$, $-NO_2$, $-SO_2H$, $-SO_3M$, $-PO_3M$, $-Si(OH)_3$, silyl, silane, aminyl, aminylhalide, hydroxyaminyl, pentose, hexose, keto, or esters.

63. The apparatus of claim 61, wherein the additive consumption inhibiting compound comprises naphthalene compounds having the following formula:



where R^5 , R^6 , R^7 , and R^8 are each independently selected from R .

64. The apparatus of claim 60, wherein the additive consumption inhibiting compound comprises from about 0.001 g/L to about 100.0 g/L of the bath.

65. The apparatus of claim 60, wherein the metal plating bath further comprises brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, or suppressors.

66. The apparatus of claim 60, wherein the metal plating bath has a pH of from 0 to about 8.0.

67. The apparatus of claim 60, wherein the metal salt comprises copper halides, copper sulfate, copper alkane sulfonate, copper alkanol sulfonate, or mixtures thereof.

68. The apparatus of claim 60, wherein the insoluble anode comprises metals of cobalt, nickel, ruthenium, rhodium, palladium, iridium, or platinum.
69. The apparatus of claim 68, wherein the insoluble anode further comprises metals of titanium, zirconium, hafnium, vanadium, niobium, or tantalum.
70. The apparatus of claim 69, wherein the insoluble anode further comprises beryllium, calcium, strontium, barium, scandium, yttrium, lanthanum, or rare earth elements.
71. The apparatus of claim 60, wherein the insoluble anode comprises iridium dioxide.
72. The apparatus of claim 60, wherein the cathode comprises a wiring board, an integrated circuit, an electrical contact surface, a connector, an electrolyte foil, a silicon wafer, a semiconductor, a lead frame, an optoelectronic component, a solder bump, a decorative article, a sanitary appliance, and the like.
73. The apparatus of claim 60, wherein the insoluble anode and the cathode have a current density of from about 1 to about 1000 amps/ft².